(12) UK Patent Application (19) GB (11) 2 179 525 (13) A

(43) Application published 4 Mar 1987

(21) Application No 8619711

(22) Date of filing 13 Aug 1986

(30) Priority data

(31) 3818/85 (32) 22 Aug 1985 (33) DK

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(51) INT CL[4]
G08B 13/24 H04B 1/59

(52) Domestic classification (Edition I)
H4L GA L
U1S 1637 2186 2187 H4L

(56) Documents cited
GB A 2164824 GB A 2133660

(58) Field of search
H4L
Selected US specifications from IPC sub-classes H04B G08B

(54) An identification system

(57) An identification system comprises an electrical interrogation apparatus with transmitting means for transmitting and r. f. signal and a receiving means, and a transponder on an object to be identified. The transmitting means include a combined transmitting and receiving coil construction on a core, the poles of which are turned in the same direction. The transmitting coil is wound around the core, and the receiving coil (30) is wound around the poles in such a manner that the coupling between the transmitting and the receiving coil is substantially zero. A directional transmitting and receiving coil construction is consequently obtained with no coupling between the transmitting coil and the receiving coil (30).

The object to be identified may be a working tool, eg a cutting tool for a production machine, the transponder being contained in a groove in the tool. The transponder may include tuned circuits and encoded information as to tool wear or service life.

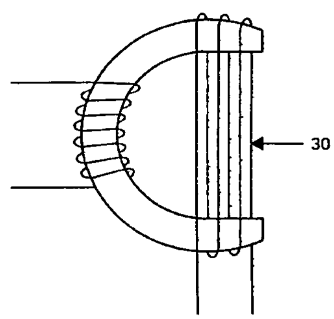

Fig. 7

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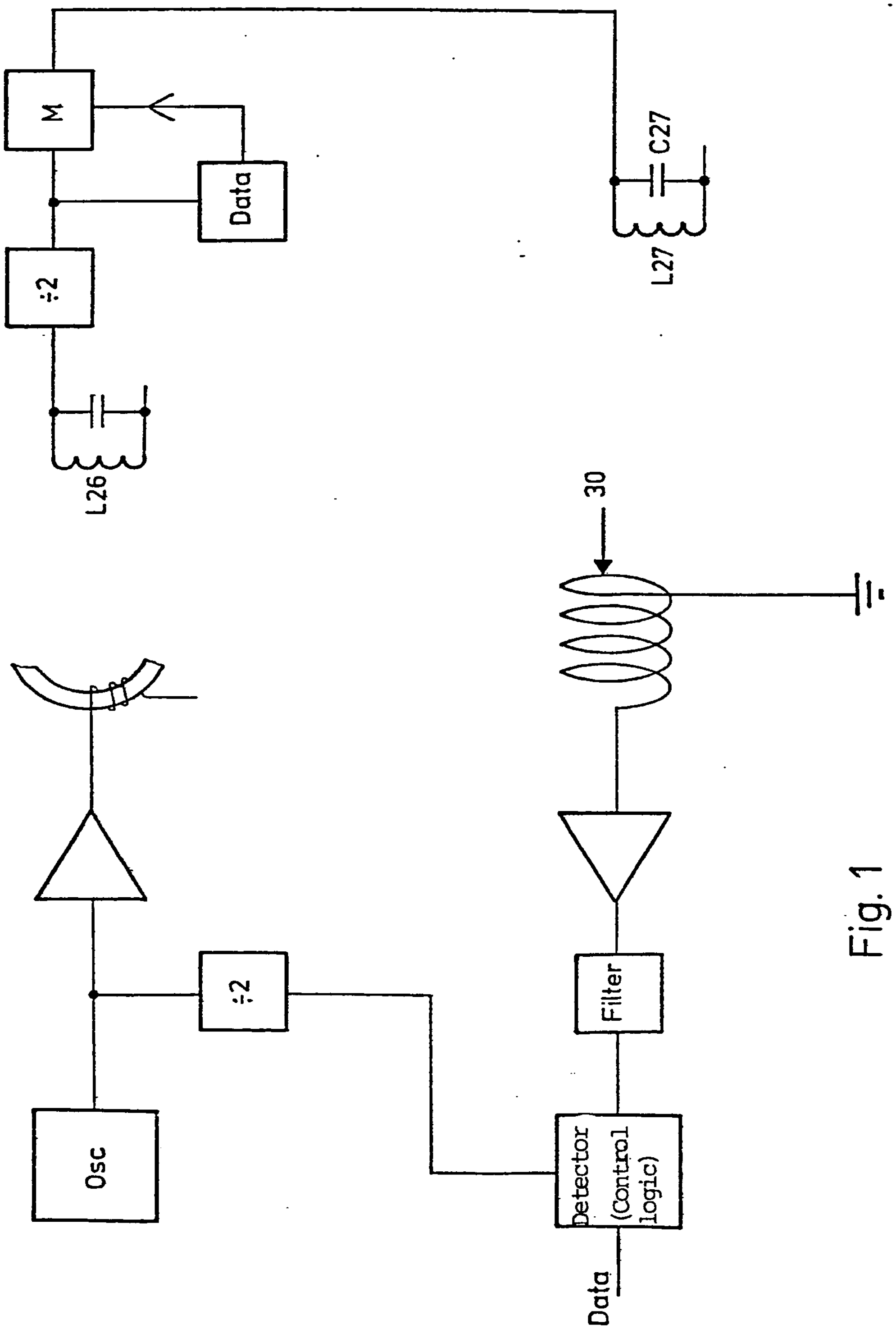
M
Data
÷2
L26
C27
L27
30
Osc
÷2
Filter
Detector (Control logic)
Data

Fig. 1

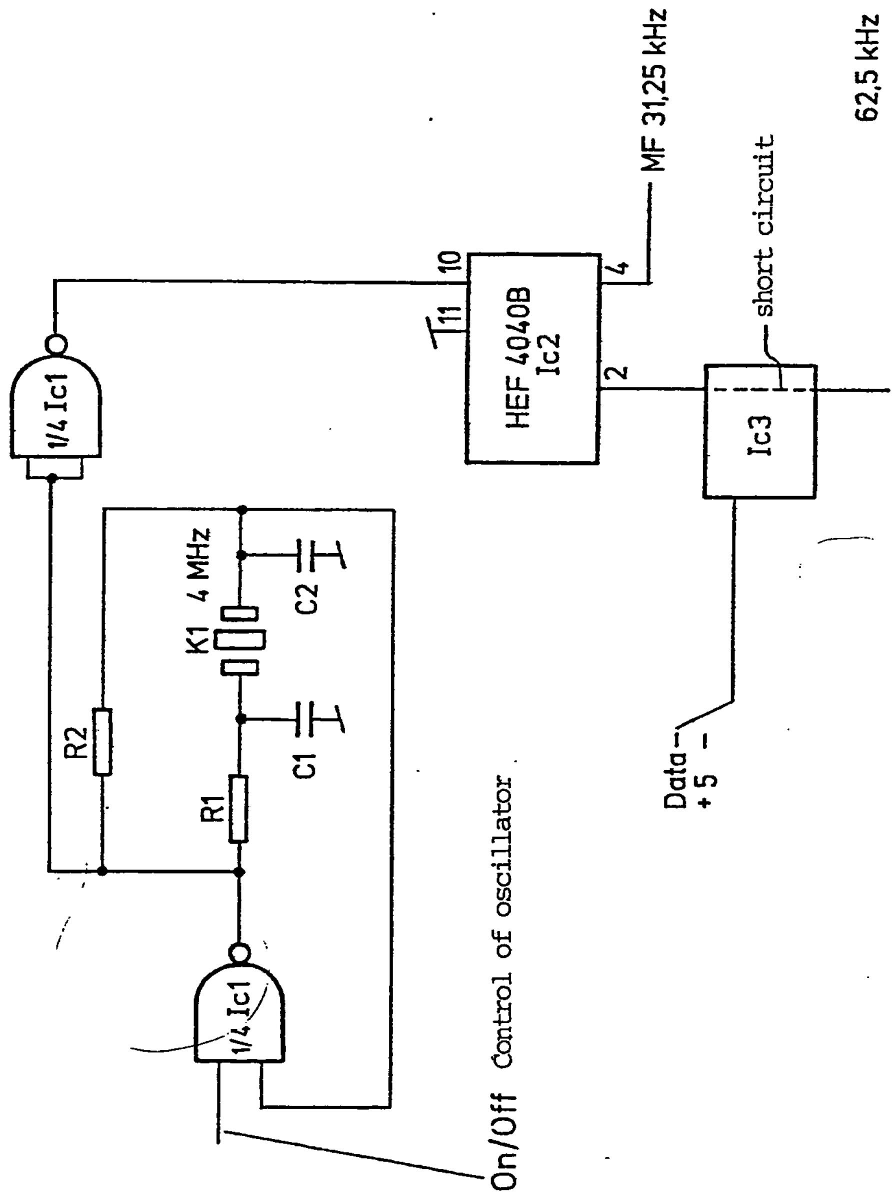
MF 31,25 kHz
62,5 kHz
short circuit
10
4
11
HEF 4040B
Ic2
2
Ic3
1/4 Ic1
K1 4 MHz
C2
C1
R2
R1
Data
+5
Control of oscillator
On/Off
1/4 Ic1

Fig. 2

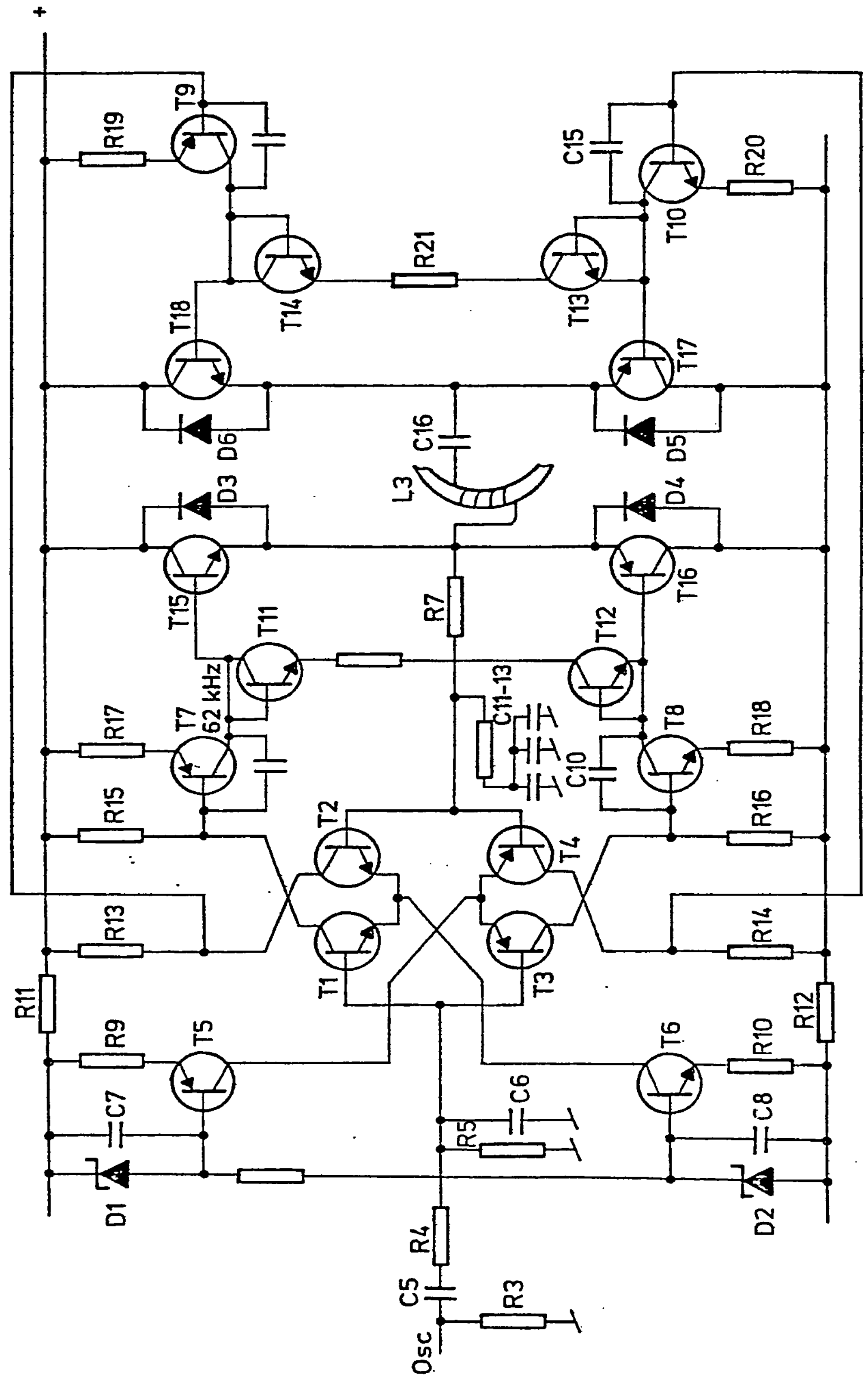
+
T9
R19
C15
T10
R20
R21
T14
T13
T18
T17
C16
D6
D5
L3
D3
D4
T15
T16
R7
T11
T12
62 kHz
T7
R17
C11-13
T8
R18
C10
R15
R16
T2
T4
R13
R14
T1
T3
R11
R12
R9
T5
T6
R10
C7
C6
C8
R5
D1
D2
R4
C5
R3
Osc

Fig. 3

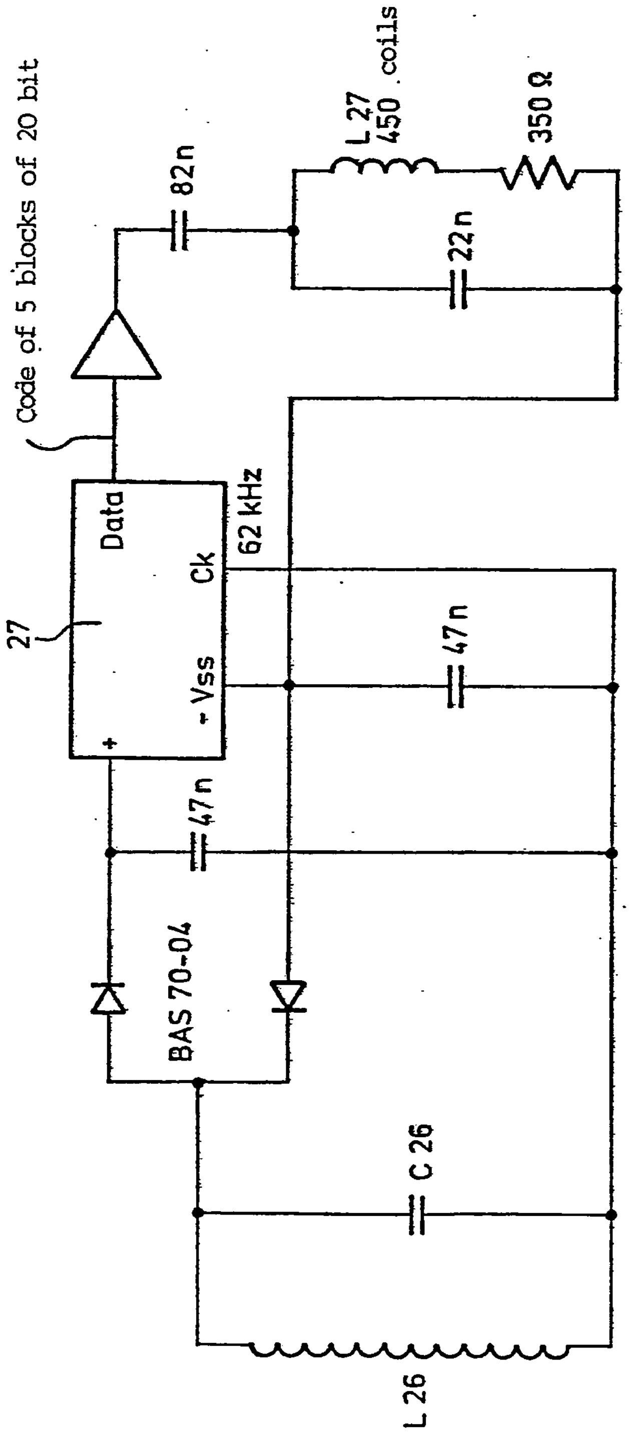
Code of 5 blocks of 20 bit
82n
L 27
450 coils
350 Ω
22n
Data
Ck
62 kHz
27
- Vss
+
47n
47n
BAS 70-04
C 26
L 26

Fig. 4

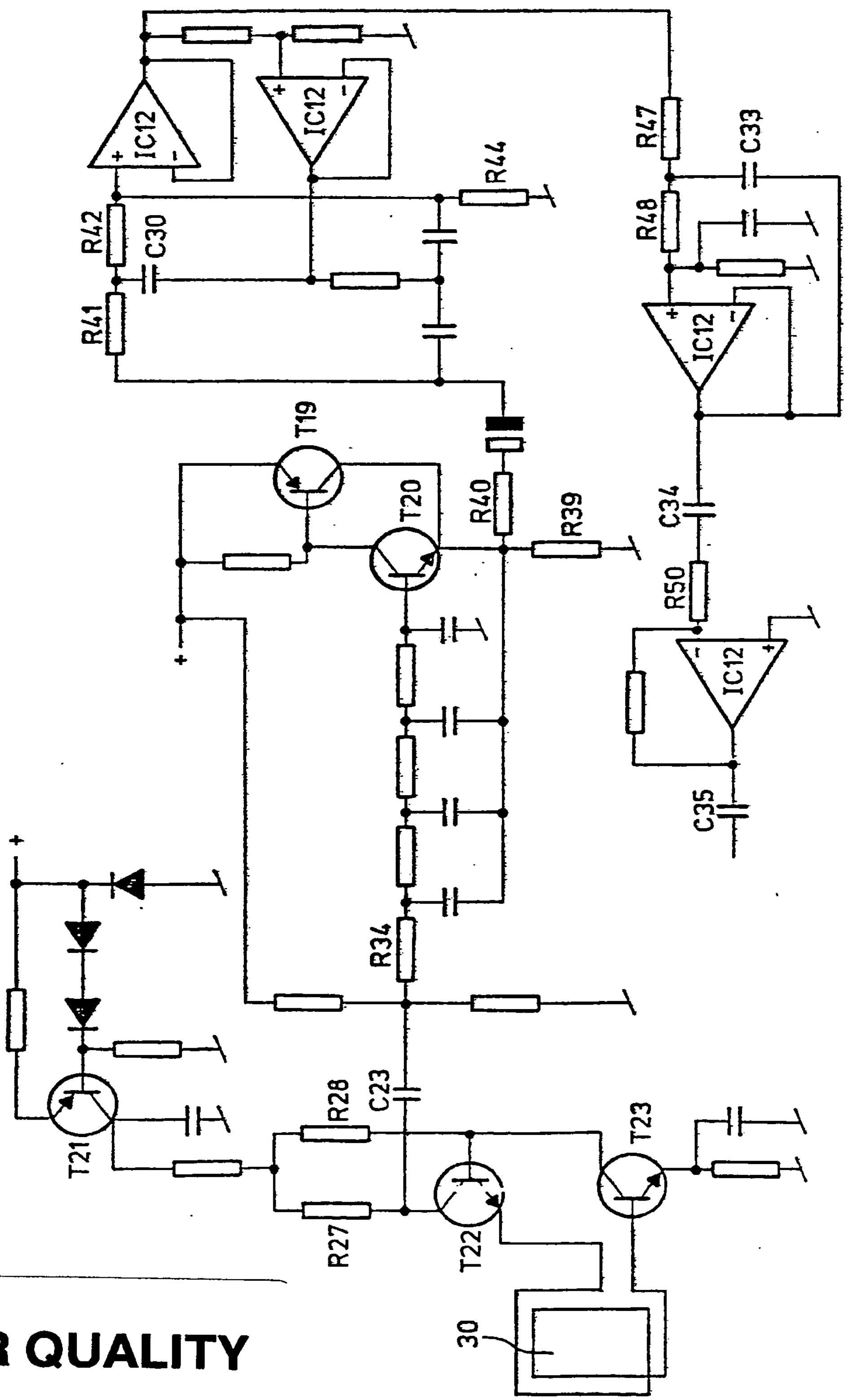
IC12
IC12
R44
R42
C30
R41
R47
C33
R48
IC12
T19
T20
R40
R39
C34
R50
IC12
C35
R34
C23
R28
R27
T21
T22
T23
30

Fig. 5

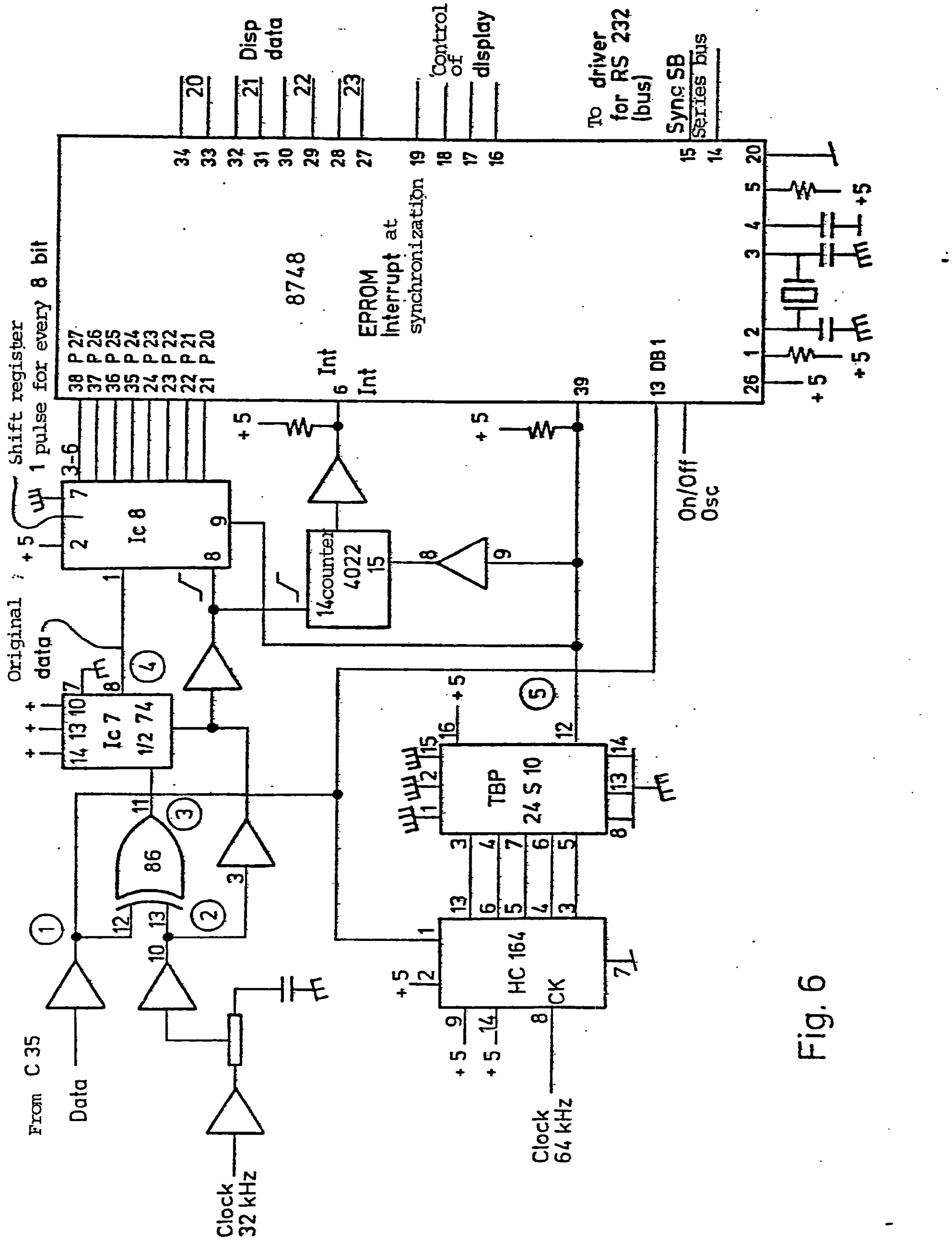
Disp data
Control of display
To driver for RS 232 (bus)
Sync SB
Series bus
8748
EPROM
Interrupt at synchronization
Int
Shift register
1 pulse for every 8 bit
Ic 8
14counter 4022
Original data
Ic 7
1/2 74
86
TBP
24 S 10
HC 164
CK
On/Off
Osc
From C 35
Data
Clock 32 kHz
Clock 64 kHz

Fig. 6

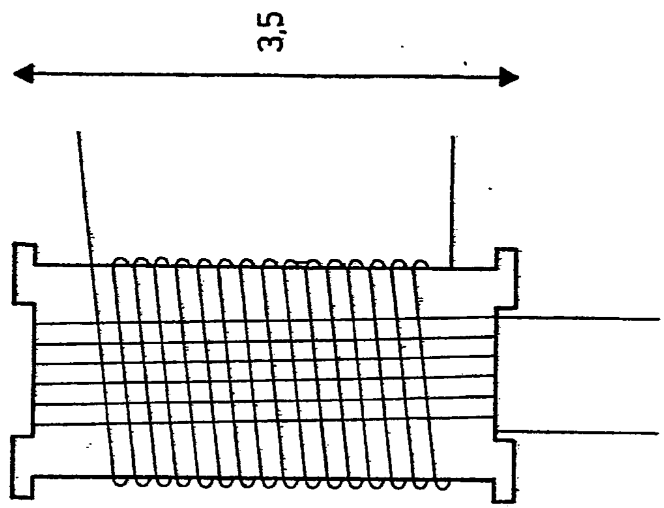

Fig. 8

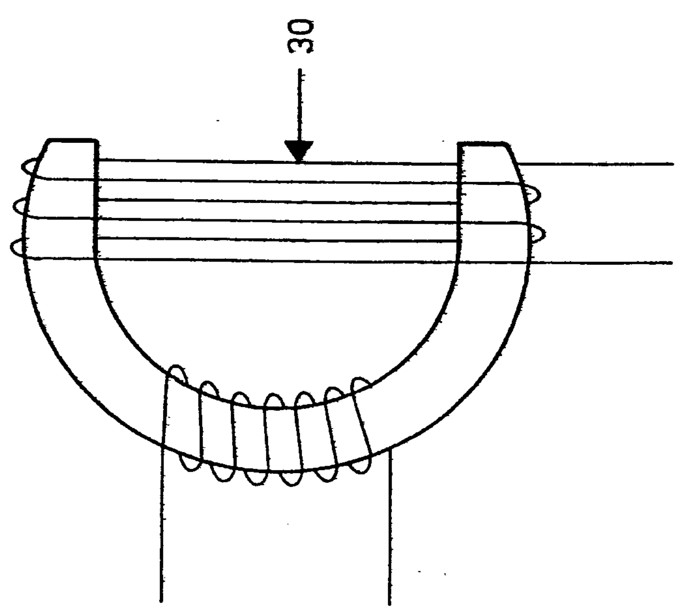

Fig. 7

SPECIFICATION

An identification system

The invention relates to an identification system comprising electrical communication apparatus with transmitting means for transmitting a signal, and a transponder in a sensor, the transmitting means including a combined transmitting and receiving coil construction.

It is the object of the present invention to provide a directional transmitting and receiving coil construction with no coupling between the transmitting and the receiving coil, and according to the invention this object is obtained by the transmitting and receiving coil construction being wound on a core, the poles of which are turned in the same direction, the receiving coil being wound around the poles in such a manner that the coupling between the transmitting coil and the receiving coil is substantially zero.

In a particularly advantageous embodiment the receiving coil and the transmitting coil in the transponder are wound on the same core in such a manner that the axes of the coils are substantially perpendicular to each other.

The invention will be described by way of example with reference to the accompanying drawings, in which

Fig. 1 is a block diagram of an identification system according to the invention, consisting of a transmitter/receiver and a transponder,

Fig. 2 is a diragram of the oscillator of the transmitter/receiver of Fig. 1,

Fig. 3 is a diagram of the transmitter circuit of the transmitter/receiver,

Fig. 4 is a detailed circuit diagram of the transponder of Fig. 1,

Fig. 5 is a diagram of the receiver circuit of the transmitter/receiver,

Fig. 6 is a diagram of a control logic connected to the receiver of Fig. 5,

Fig. 7 illustrates a combined transmitting and receiving coil construction, and

Fig. 8 illustrates the transmitting and receiving coils in the transponder.

The identification system is for use in identifying single parts or complete metal constructions. In operating for example large production machines it is necessary to transport several different working tools, e.g., turning tools or cutting edges, and the particular working tool required must be identified. The working tool has a groove for receiving a transponder which identifies a tool. The transponder may also contain encoded information as to wear (service life).

It is found that a shielding effect takes place so that signals below a certain frequency are required. In a particular example the cut-off frequency is at about 80 kHz, and a working frequency at 62 kHz is chosen. The transmitting coil L3 is wound around a U-shaped core with poles pointing forwards — shown in part in Figs. 1 and 3. Fig. 7 shows the combined transmitting and receiving coil construction with its complete core. As a result, radiation in a particular direction is obtained. The radiation signals are received by a coil L26 in a tuned circuit of a transponder. The frequency of the received signal is divided by two and the half frequency output is applied to a custom-design-circuit (DATA) and then to a modulator (M). The custom-design-circuit outputs a code (Manchester code) which is supplied to the modulator (M). The modulated signal is supplied to a second tuned circuit (L27, C27) functioning as transmitter. The coils of the transponder (L26, L27) are substantially perpendicular to each other and may optionally be wound on a common core — see Fig. 8.

The advantage in dividing the frequency by two is that the signal transmitted by the transponder is not disturbed by the harmonics of the signal received by the transponder.

The receiving coil of the transmitter/receiver is constituted by a coil 30 wound around the poles of the U-shaped core of the transmitting coil. The signal received from the transponder is supplied to an amplifier and a filter and subsequently to a detector, which is synchronized with the transmitted signal by supplying the output of the oscillator to a divide-by-two circuit the output of which is supplied to the detector.

As mentioned above the so-called Manchester code is utilized. The signals comprise 3 synchronizing bits, 16 information bits and a parity bit.

Fig. 2 illustrates the oscillator which produces a signal at 62.5 kHz for transmission and a referenced signal at 31.25 kHz.

The Transmitter (Fig. 3)

The oscillator signal of 62.5 kHz is introduced at capacitor C5 and is then conducted to a symmetrical, double differential amplifier T1, T2, T3, T4 succeeded by the pulse stage T7, T8. The transmitter transmits a signal through a tuned output stage L3, C16. Modulation may optionally be performed in IC3 in the oscillator, as indicated in Fig. 2.

The Transponder (Fig. 4)

The transponder comprises the tuned receiver circuit L26, C26, a number of diodes and a number of smoothing capacitors and a custom-design-circuit 27. A rectified voltage of about 3V is supplied to the circuit 27. When clock pulses are supplied at CK an output signal appears at the output terminal DATA. The output signal is constituted by a code consisting of 100 bits, which in turn is divided into five blocks of 20 bits each. Each individual block of 20 bits is composed of 16 data bits, a parity bit and 3 synchronizing bits. The output signal is supplied to the transmitting coil L27. A division of the frequency by two takes place in the custom-designed CMOS-circuit, so that signals with a frequency of 31.25 kHz are transmitted.

The Receiver (Fig. 5)

The transmitted signal is received by the coil 30 in the receiver in which the signal is amplified and after amplification and filtering is supplied to an amplifier IC12 increasing the signal level to a suitable value.

Control Logic (Fig. 6)

Data and clock pulses are introduced in the control logic illustrated in Fig. 6. The data signals are supplied from capacitor C35 of the receiver circuit (Fig. 5). An exclusive OR-gate 86 is supplied the data signals and 32 kHz clock signal and drives an integrated circuit IC7 so that at pin 8 of IC7 the original data from the transponder appears. HC164 and TBP24510 are a

decoding circuit for the synchronizing bits thus providing synchronizing pulses for use in decoding the data. The synchronizing pulses are suppied to pin 9 of IC7 and to a microprocessor, type 8748. The reason for a separation into two circuits is that the synchronizing pulses are 1.5 times the transmitted frequency, whereas the other pulses follow the frequency. The synchronizing pulses are supplied to pin 39 of the μ-processor 8748. The μ-processor is interrupted when receiving a synchronizing pulse. A counter 4022 is simultaneously reset by a synchronizing pulse. 8 clock pulses are now counted, and during the 8 pulses 8 data bits are encoded into a shift register IC8 (at terminal 8 of IC7). When the count in the counter 4022 is 8, the counter transmits a pulse to the interrupt terminal (6) of 8748 for encoding bits, i.e., one pulse for every 8 bits. 16 bits are entered when this has taken place twice after a synchronizing pulse. The data consists of blocks of 16 bits succeeded by a single parity bit and 3 synchronizing bits. After two interrupt signals and introduction of 2 x 8 bits a new synchronizing pulse is transmitted and the whole procedure is repeated. 5 blocks in all are transmitted. There is, however, a difference between the synchronizing pulses. One pulse starts at a high level and descends to a low level. This synchronizing pulse, which is supplied to the pin 13 of the μ-processor is decoded, by software, in the μ-processor. There will then be output at display terminals 27 to 30 or at terminals 14 and 15.

CLAIMS

1. An identification system comprising an electrical communication apparatus with transmitting means for transmitting a signal, and a transponder in a sensor, the transmitting means including a combined transmitting and receiving coil construction, characterised in that the combined transmitting and receiving coil construction is wound on a core, the poles of which are turned in the same direction, the receiving coil being wound around the poles in such a manner that the coupling between the transmitting coil and the receiving coil is substantially zero.

2. An identification system as claimed in claim 1, characterised by the core being substantially U-shaped or loop-shaped.

3. An identification system as claimed in claim 1, characterised by the core being circular arc-shaped.

4. An identification system as claimed in claim 1, characterised in that the core is constituted by two ferrite rods interconnected by means of a magnetically conducting material.

5. An identification system as claimed in any of the preceding claims, in which the transponder has a receiving coil and a transmitting coil, characterised in that the transponder coils are wound on a common core in such a manner that the axes of the coils are perpendicular to each other.

6. An identification system substantially as described hereinbefore with reference to the accompanying drawings.

Printed in the United Kingdom for Her Majesty's Stationery Office, 8818935, 3/87 18996. Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY, from which copies may be obtained.